Redfish Creek Prescribed Burn
Vegetation Monitoring Project

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ABSTRACT

This report outlines understory vegetation composition and cover development after a fall slashburn on a seed tree block in the Interior Cedar - Hemlock dry warm subzone (ICHdw). Vegetation was monitored for the first four years on three areas at the site. The areas differed in terms of treatment (no burn, moderate and severe burn) and site (two areas had subxeric to submesic soil moisture regimes while the other was mesic to subhygric). The sites differed most dramatically in terms of species composition. Thimbleberry, paper birch, and Hooker's fairy bells were the dominant species on the unburned area four years after treatment. On the drier, more intensely burned area, redstem ceanothus and fireweed were dominant. Thimbleberry, common horsetail, paper birch, American vetch, and fireweed were the dominants in terms of cover after four years on the site influenced by seepage. The different seedling environment found on the three areas suggests that fall burning in the ICHdw can create significant competition problems.

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1.0 INTRODUCTION

Broadcast burning is used primarily for fire hazard reduction and site preparation in the Nelson Forest Region. Fire can have a dramatic effect on vegetation. It can change the vegetation community through various means which include: destroying above and below ground plant parts and seeds, stimulating root suckering and seed germination, and altering surface substrate, nutrient availability, and thermal regimes.

Understory vegetation is important for wildlife as feeding, resting, hiding, or nesting cover. Understory vegetation has a large role in ecosystem functions, such as nutrient cycling and soil stabilization. As well, vegetation may potentially compete with commercial tree regeneration. Vegetation succession following forest management activities is, therefore, of interest to a wide variety of resource users and managers.

This project was initiated as a component of the operational broadcast burning - site productivity trial (E.P.1017). The objectives for the overall study were to monitor and compare the following on burned and unburned portions of the cutblock:

1. short- and long-term changes in soil chemistry;

2. rates of survival and growth of planted seedlings; and

3. vegetation composition and cover within the first five years after burning.

Work addressing seedling performance was carried out initially under FRDA project 3.25, is outlined in FRDA Research Memo No.119 (FRDA 1989), and is ongoing. Soil chemical sampling has been carried out pre- and post-burn. Additional sampling is planned when budgets permit (Curran, M.P., pers. comm. 1994) and will be reported subsequently.

2.0 STUDY SITE DESCRIPTION

The study site is located above the West Arm of Kootenay Lake, about 25 kilometers east of Nelson. It lies within the Dry Warm Interior Cedar-Hemlock biogeoclimatic subzone (ICHdw) (Braumandl and Curran 1992) at a mean elevation of 1050 m. The size of the block is 40 ha. The predominant site series is the CwFd - Falsebox: subxeric to submesic phase (ICHdw/01a). Slopes are about 30 % and the aspect is south-southwest. The soil

phase (ICHdw/01a). Slopes are about 30 % and the aspect is south-southwest. The soil is derived from granitic rock with only small amounts of volcanic ash in the upper soil, judging from the sandy texture. Soils are deep with an upper layer of 15 to 40 cm of silt loam or sandy loam with 10 to 35% coarse fragments over a coarser layer of sandy loam to loamy sand with 20 to 45% coarse fragments. The stand, prior to harvest, consisted of mature Douglas-fir, western larch, ponderosa pine, and paper birch. There was a dense understory of intermediate western redcedar and grand fir across much of the stand.

A seed tree cut was carried out in 1984, leaving large Douglas-fir and ponderosa pine seed trees. A prescribed burn was carried out on September 24 and 25, 1985. Slash loadings on the block varied from 100 to 205 t/ha. These high levels were due to areas of dense western red cedar and grand fir regeneration. Prior to slashing, this regeneration was about 3 m tall. Slash accumulations were over a meter deep in many locations. Fire intensity as measured by fuel consumption was variable but generally high. Measured woody fuel consumption varied from 43 to 76%, while forest floor consumption was between 30 and 67%.

3.0 METHODS

Within the burn, two vegetation monitoring macroplots were established, using a sampling scheme devised by Demarchi [1]. This technique uses line intercept transects (5 - 15 m) to estimate shrub cover, belt transects (5 - 15X1 m) to estimate shrub density, and small "Daubenmire" quadrats (5 - .2X.5 m per 15 m transect) to estimate herb cover. The area initially selected for the unburned control was burned so, as a result, the control was placed in an area where the macroplot layout could not be laid out. While the arrangement of sampling transects and quadrats was different in the control, a similar length of line and number of quadrats was installed. Measurements were made each year, during late August or early September, from 1985 (pre-burn) to 1989. The location for the control was not determined until 1986. Therefore, there were no measurements in the control in 1985. Monitoring ended due to an unscheduled operational manual brushing treatment in 1991.

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[1] D. A. Demarchi. 1971. An outline of a quantitative ecology technique employing a macroplot with subsampling procedures. B.C. Fish and Wildlife Branch. Victoria. mimeo. 14 pp.

4.0 RESULTS AND DISCUSSION

Due to a number of factors, the two burn plots were placed on contrasting sites. Plot location was done late in the summer when evidence of soil seepage is not readily apparent. Plot location was hampered by the heavy slash. Both vegetation macroplots within the burn had very little vegetation pre-burn, presumably due to low light levels at the forest floor caused by the dense canopy. Plot 2 was influenced by some seepage, while Plot 1 soils were as described above. Plot 2 also appeared to have burned more intensely than Plot 1 (67% versus 29% duff consumption on the nearest fuel plots, S. Thompson, unpublished data). The new control site had a more open grown stand prior to harvest and had, therefore, more understory vegetation. In light of these shortcomings and the fact that this is an unreplicated trial, the results should be viewed as descriptions of how three distinct sites in the ICHdw developed after slash burning in two cases and without site preparation in the case of the control.

The following is a summary of some of the major trends. Plot 2 (the seepage site) has consistently had more total cover than the other two plots (Figure 1). Plot 2 is also the only plot where herbs have consistently predominated over shrubs (Figure 2). However, four years after burning, shrub cover had almost equaled herb cover on plot 2.

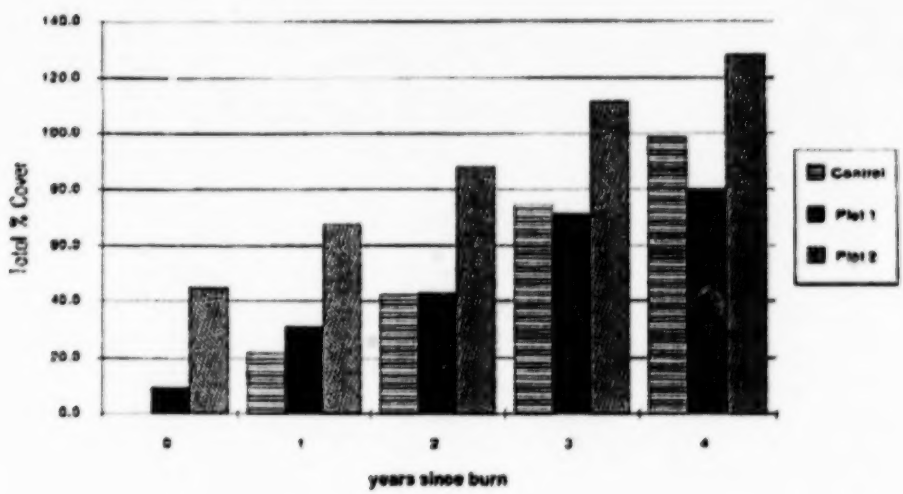

Figure 1. Total vegetation cover

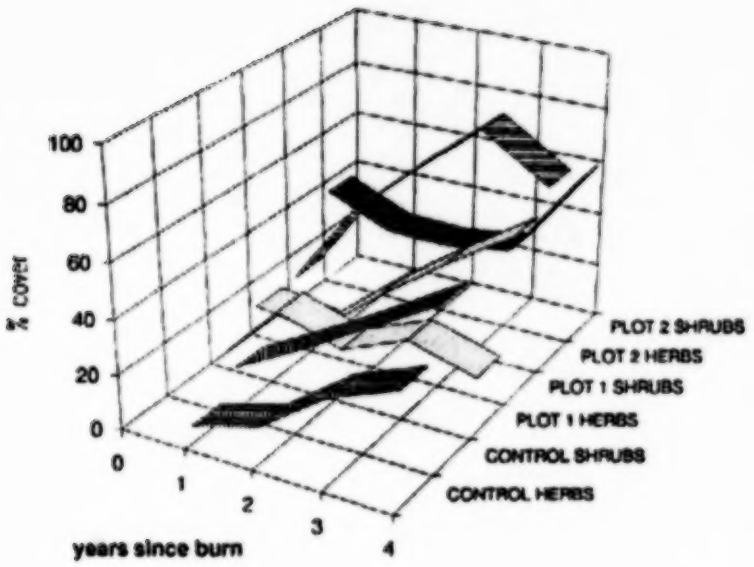

Figure 2. Herb and shrub cover by plot

Total vegetation cover on the control at one year post-burn was slightly lower than plot 1. Three years later this trend was reversed.

The dominant species on the three plots were different. Tables 1 to 3 present the cover data for major species (all species that had 5% or more cover at any measurement).

The unburned (control) plot had a steady increase in herb cover from 6% the first year measured (1986) to 41% in 1989. Shrubs in the unburned plot had also steadily increased from 16 percent (1986) to 58 percent (1989). The paper birch (*Betula papyrifera*) was almost exclusively resprouts from large (*circa* 25 cm) stumps. The aspen had been affected by a defoliator in 1987 and its coverage has waned. By 1989, the average height of thimbleberry was 75 cm. and paper birch was 190 cm.

Table 1. Control (unburned) major species cover (%) by year

	1985 (pre burn)	1986	1987	1988	1989
Herbs					
Epilobium angustifolium	*	2.9	3.8	7.0	8.9
Gayophytum sp.	*	0.0	2.8	9.0	7.8
Disporum hookerii	*	0.1	0.2	6.4	10.6
Total Herbs (all species)	*	6.3	13.4	31.2	40.8
Shrubs					
Pachistima myrsinites	*	2.0	2.0	4.1	6.0
Rubus parviflorus	*	9.0	6.4	13.1	22.0
Populus tremuloides	*	5.9	3.5	2.7	1.0
Betula papyrifera	*	3.7	8.8	12.5	21.0
Total Shrubs (all species)	*	15.6	28.9	43.2	57.7

* Control not established until 1986

Herb cover remained quite constant following one year after the burn on Plot 1. There was a slight reduction in cover in the second year after the burn. This was at least in part due to individual plant size being reduced. The height of herbs such as fireweed and horseweed (*Conyza canadensis*) was significantly taller in the first year after the burn than in subsequent years (120 cm. versus 80 cm. for fireweed). The single most dominant plant on the entire Redfish site was redstem ceanothus (*Ceanothus sanguineus*). Before the burn there was no evidence of ceanothus on site. By 1989, its cover was 34% and average height was 200 cm. This appears to be exceptional growth. Miller (1986a) in reviewing Inland Northwest studies reports ceanothus heights of 55 to 145 cm, five years after burning. Ceanothus is a seed-banking species. The buried seeds remain viable for very long periods and then are stimulated to germinate by fire (Lotan 1986). Ceanothus was the only shrub species on Plot 1 to increase in cover. Other species such as sticky currant (*Ribes viscosissimum*) and thimbleberry declined after reaching maximum covers two years after the burn.

Table 2. Plot 1 major species cover (%) by year

	1985 (pre burn)	1986	1987	1988	1989
Herbs					
Epilobium angustifolium	0.0	15.4	11.0	19.6	13.7
Total Herbs (all species)	0.0	24.8	17.2	27.4	20.3
Shrubs					
Ceanothus sanguineus	0.0	2.5	9.6	20.4	33.6
Ribes viscosissimum	0.0	1.6	6.9	8.4	6.4
Rubus parviflorus	0.0	1.3	2.7	3.7	5.6
Betula papyrifera	2.3	0.7	6.0	8.9	5.5
Thuja plicata	7.0	0.0	0.0	0.0	0.0
Total Shrubs (all species)	9.3	6.4	25.8	43.8	60.0

Plot 2 had a number of herb species that were not found on the other plots, presumably due to the seepage. Shrub covers remained fairly constant between 1986 and 1988, with a marked increase in 1989 to a total cover of 60%. In 1989, thimbleberry average height was 110 cm, while paper birch was 210 cm. As in the other plots, paper birch was found primarily as stump resprouts.

Table 3. Plot 2 (seepage site) major species cover (%) by year

	1985 (pre burn)	1986	1987	1988	1989
Herbs					
Equisetum arvense	3.1	6.7	19.3	21.8	20.5
Cirsium arvense	1.8	1.4	5.8	6.6	3.2
Cirsium vulgare	0.0	3.8	3.8	13.3	4.1
Epilobium angustifolium	0.0	19.2	7.2	8.0	13.0
Vicia americana	0.0	4.2	13.4	16.7	14.2
Lathyrus ochroleucus	0.0	3.4	7.6	9.9	7.7
Total Herbs (all species)	9.8	42.5	63.7	83.2	67.7
Shrubs					
Rubus parviflorus	4.6	13.8	16.8	19.3	38.3
Betula papyrifera	27.1	3.9	4.6	3.6	16.4
Total Shrubs (all species)	35.2	25.1	24.4	28.2	60.5

The seedling environments produced by the vegetation on these three plots were quite different. On the unburned area, apart from the area directly under the canopies of

resprouting paper birch, light levels were fairly high and physical damage was not noted. The seedlings that were planted in 1986 were by 1989 well above most other vegetation. This is in contrast to Plot 1 where, although total cover was less, numerous planted seedlings were overtopped by a dense canopy of ceanothus.

The study of plantation performance (FRDA project 3.25) (FRDA 1989) found that seedling growth on the burned area, without vegetation control, was less than on the unburned area after six seasons of growth (the duration of that study). The greatest growth over six years was on the burned area with manual vegetation removal.

Plot 2 had numerous planted seedlings that were either smothered by vetch (*Vicia*) or peavine (*Lathyrus*) or overtopped by thimbleberry.

The ceanothus that is so predominant over most of the burn area is serving a number of beneficial functions. It is providing preferred ungulate browse and hiding cover and is probably fixing nitrogen. There may be certain circumstances where the presence of ceanothus is beneficial to conifer growth (Binkley and Husted 1983; Youngberg et al. 1979), as well as to soil nitrogen levels (Youngberg and Wollum 1976; Zavitkovski 1966). There are also studies showing negative growth response (Petersen and Newton 1982, 1985) and no net increase in soil nitrogen (Zavitkovski and Newton 1968, Binkley 1986). The vetch and peavine also fix nitrogen. Nitrogen may be in short supply after a relatively intense burn on this site because it has relatively little soil organic matter.

5.0 CONCLUSIONS

Burning in the ICHdw on site series phases 01a and 01b on south aspects (and likely also in the ICHxw and IDFun) will encourage species such as ceanothus, vetch and peavine. Spring burning may be advisable if required in the ICHdw. Ceanothus regeneration is greater after fall, rather than spring burns (Leege 1968; Noste 1982).

If burning is carried out, vegetation control may be required to achieve free growing conifers within a short time frame. However, control of these species can be difficult. Ceanothus vigourously resprouts after manual treatment. Chemical treatment is the only practical effective control for peavine and vetch which may not be an option on many

sites. These species may be fulfilling a needed ecological function by adding to soil nitrogen levels and providing wildlife food and shelter. Pre harvest burns, in conjunction with silvicultural systems that maintain sufficient overstory to keep these very shade intolerant species at low levels, have been suggested by American silviculturists (Lotan 1986) for this type of site. Mechanical site preparation or no treatment may result in less vigorous vegetation (Miller 1986b),but compaction must be avoided. This is particularly true in the ICHdw where many soils have an easily compacted silty capping, as on this site.

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